

REMARKS

Applicants have amended their claims in order to further clarify the definition of various aspects of the present invention. Specifically, Applicants have amended claim 1 to recite that the protrusions of larger height have a stack structure of at least two layers respectively of different materials, the different materials including silicon oxide and silicon. Note, for example, the paragraph bridging pages 5 and 6 of Applicants' specification.

In addition, Applicants are adding new claims 12-15 to the application. Claim 12, dependent on claim 1, recites that the substrate is of silicon, protrusions of smaller height include a layer of silicon oxide adjacent the silicon substrate, and the protrusions of larger height include a layer of silicon oxide adjacent the silicon substrate and a layer of silicon over the layer of silicon oxide; and claim 13, dependent on claim 12, recites that the silicon substrate is a single crystal silicon substrate. In connection with claims 12 and 13, note, for example, Fig. 2H, and, in particular, single-crystal silicon substrate 201, silicon oxide film 202 and silicon film 203. Claims 14 and 15, each dependent on claim 1, respectively recites that the substrate is a silicon substrate, and that each of the plurality of protrusions include a silicon oxide layer adjacent the substrate; and recites that the stamper has structure so as to be used for processing a resist to be a mask that performs a processing for a substrate being processed. Note, for example, the paragraph bridging pages 11 and 12 of Applicants' specification.

Applicants respectfully submit that all of the claims presented for consideration by the Examiner patentably distinguish over the teachings of the prior art applied by the Examiner in rejecting claims in the Office Action mailed April 27, 2006, that is, the U.S. patents to Okazaki, et al., No. 4,723,903, and to Maenza, et al., No. 5,494,782, under the provisions of 35 USC 102 and 35 USC 103.

It is respectfully submitted that these references as applied by the Examiner would have neither taught nor would have suggested such a stamper as in the present claims, including, inter alia, a plurality of protrusions having different heights formed on one of the surfaces of a substrate, with the protrusions of larger height having a stack structure of at least two layers respectively of different materials, the different materials including silicon oxide and silicon. See claim 1.

In addition, it is respectfully submitted that these references as applied by the Examiner would have neither taught nor would have suggested such stamper as in the present claims, fabricated by forming a film of a covering material on the surface of an original stamper as in claim 1 having a plurality of protrusions of different heights, such original stamper having such protrusions of larger height respectively of the different materials including silicon oxide and silicon, and wherein the original stamper is removed, the claimed stamper having the film of the covering material (see claim 7); or wherein the stamper is fabricated by forming a film of a first covering material on the surface of the aforementioned original stamper according to claim 1, with a film of a second covering material being formed on the surface of the film of the first material having the protrusions obtained by removing the original stamper, and removing the film of the first covering material, with the stamper having the film of the second covering material (see claim 8).

Furthermore, it is respectfully submitted that the applied references would have neither disclosed nor would have suggested such stamper as in the present claims, having features as discussed previously in connection with claim 1, and wherein the substrate is of silicon, with protrusions of smaller height including a layer of silicon oxide adjacent the silicon substrate, and the protrusions of larger height including a layer of silicon oxide adjacent the silicon substrate and a layer of silicon over the layer of silicon oxide (see claim 12), in particular, wherein the silicon

substrate is a single crystal silicon substrate (see claim 13); or wherein the substrate is a silicon substrate, with each of the plurality of protrusions including a silicon oxide layer adjacent the substrate (see claim 14).

In addition, it is respectfully submitted that the teachings of the applied references would have neither disclosed nor would have suggested such stamper as in the present claims, having features as discussed previously in connection with claim 1, in particular, wherein the different materials of the stack structure of at least two layers includes silicon oxide and silicon, and, moreover (but not limited to), wherein the protrusions of smaller height, among the protrusions of different heights, have a stack structure with a smaller number of layers than the protrusion of larger height (see claim 2); and/or wherein materials of adjoining ones of the protrusions of larger height have different etching rates for a predetermined etching technique (see claim 3); and/or wherein the material of the substrate and the materials of the protrusions in contact with the substrate have different etching rates (see claim 4); and/or wherein the portions of the protrusions at the same height from the surface of the substrate are formed of the same type of material (see claim 5), in particular, wherein the portions of the protrusions in steps of different heights are each formed of a single material (see claim 6); and/or wherein the stamper has structure so as to be used for processing a resist to be a mask that performs a processing for a substrate being processed (see claim 15).

The present invention is directed to a stamper, which can be used for processing a resist which, after processing thereof, is used as a mask in processing a substrate.

As a technique for forming a fine pattern at a low cost, there has been disclosed in U.S. Patent No. 5,772,905 a stepped stamper having the same protrusions and recesses as the desired pattern to be formed on the substrate,

wherein this stepped stamper is pressed on a resist film layer formed on the surface of the substrate to be processed, to transfer a predetermined pattern. However, this stamper described in No. 5,772,905 has disadvantages, in that it requires a plurality of stamps of patterns to be prepared, to form a structure configured of a plurality of patterns. Moreover, the positions of the patterns are required to be matched with each other, thereby increasing fabrication costs. Note, in particular, the paragraph bridging pages 1 and 2, and the first full paragraph on page 2, of Applicants' specification.

In addition, it is difficult to provide protrusions of proper height, particularly wherein the stamper is to have a plurality of protrusions of different heights.

Against this background, Applicants provide a stamper in which a plurality of patterns can be transferred collectively (e.g., at the same time), and wherein the protrusions providing the patterns can be formed simply and accurately. Applicants have found that by providing the protrusions wherein the protrusions of larger height have a stack structure of at least two layers respectively of different materials, the different materials including silicon oxide and silicon, the protrusions of different heights can be formed by simple etching techniques and can be formed with highly accurate heights. In particular, the combination of silicon and silicon oxide as different materials in forming the protrusions of larger height is excellent in etching selectivity compared with, for example, the case of metal layers such as in Okazaki, et al. (discussed further infra), and is also accurate for controlling pattern heights with the etching selectivity utilized.

The stamper according to the present invention has structure which can be used for processing a resist which becomes a mask for processing an object substrate. The resist formed through use of the stamper according to the present invention is excellent in dimensional accuracy, so that such resist when used as a

mask can effectively be used in accurately etching fine patterns in the object substrate.

Okazaki, et al. discloses a stamper for replicating high-density data recording disks such as optical disks or VHD disks recorded with high-density data. The substrate is coated with a first metal film which is made of a material different from the substrate and which can be etched well by a first etching; and the first metal film is coated with a second metal film which can be etched well by a second etching capable of etching a photoresist film and by a third etching, such first etching being such that the substrate cannot be etched well and the third etching being selected such that the first metal film cannot be etched well. Note column 2, lines 21-29. See also Fig. 3(d) and the description in connection therewith in column 2, lines 49-59. This patent discloses that the substrate is generally made of a metal, but may be made of a metal coated with another metal. See column 2, lines 65-67. This patent further discloses that the stamper may be coated with a protection layer of Au or the like so as to improve the separation property upon the replication and/or the stability and lifetime of the stamper. See column 3, lines 4-7 and 62-67. Note also column 4, lines 48-52.

It is emphasized that Okazaki, et al. discloses a stamper for replicating high-density data recording disks, and utilizes metal for the stacked layers forming protrusions. It is respectfully submitted that this reference would have neither disclosed nor would have suggested such stamper as in the present claims, having protrusions of different heights and wherein the protrusions of larger height have a stack structure with at least two layers respectively of different materials, the different materials including silicon oxide and silicon. Clearly the metal layers as in Okazaki, et al., used in providing protrusions extending in different heights from the substrate, would have neither taught nor would have suggested materials of layers of the

protrusions as in the present claims, and/or wherein the stamper has a structure for processing a resist, as in the present claims.

The contention by the Examiner on page 2 of the Office Action mailed April 27, 2006, that Okazaki, et al. discloses protrusions of larger height having a stack structure of at least two layers of at least two types of materials, is noted. However, as discussed in the foregoing, Okazaki, et al. discloses layers of metal, utilized in replicating disks, which layers of metal would have neither taught nor would have suggested the layers of materials as in the present claims, useful in processing a resist to be a mask, or advantages thereof with respect to simplified and accurate etching for providing protrusions of accurate height.

It is respectfully submitted that the additional teachings of Maenza, et al. would not have rectified the deficiencies of Okazaki, et al., such that the presently claimed invention as a whole, including the subject matter of claims 7 and 8, would have been obvious to one of ordinary skill in the art.

Maenza, et al. discloses optical disk mastering wherein the stamper or mother is formed directly by laser ablation of a metal substrate. Note, for example, column 3, lines 20-22, of Maenza, et al. This patent discloses that from the mother, a plurality of stampers can be formed in conventional fashion by repeatedly electroplating and removing the electroplating material from the ablated conductive substrate. See column 3, lines 39-42. Note also column 3, lines 22-36, 43-46 and 54-56.

Even assuming, arguendo, that the teachings of Maenza, et al. were properly combinable with the teachings of Okazaki, et al., it is respectfully submitted that the combined teachings of these references would have neither taught nor would have suggested such stamper as in the present claims, including layers made of materials

as in the present claims, and wherein, moreover, such stamper of layers of material including silicon oxide and silicon are used to form a stamper as in claims 7 and 8.

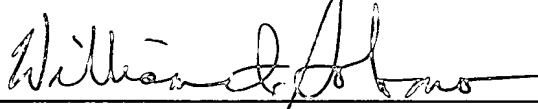
The Information Disclosure Statement submitted June 13, 2006, is noted. As shown therein, such Information Disclosure Statement satisfied applicable requirements of 37 CFR 1.97 and 1.98. Consideration of the documents submitted therewith, upon further examination of the above-identified application, is respectfully requested.

In view of the foregoing comments and amendments, reconsideration and allowance of all claims presently in the application are respectfully requested.

To the extent necessary, Applicants petition for an extension of time under 37 CFR 1.136. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to the Deposit Account of Antonelli, Terry, Stout & Kraus, LLP, Deposit Account No. 01-2135 (case No. 500.42486X00) and please credit any excess fees to such Deposit Account.

Respectfully submitted,

ANTONELLI, TERRY, STOUT & KRAUS, LLP

By 
William I. Solomon
Registration No. 28,565

WIS/ksh
1300 N. Seventeenth Street
Suite 1800
Arlington, Virginia 22209
Tel: 703-312-6600
Fax: 703-312-6666